

**REMARKS**

Claims 1 through 62 are currently pending in the application.

Claims 33 through 57 are withdrawn from consideration in the Office Action as being directed to a non-elected invention.

This amendment is in response to the Office Action of September 25, 2001.

Claims 3, 7, 8 and 61 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant notes with appreciation the allowance of claim 62.

After carefully considering the cited prior art, the rejections, and the Examiner's comments, Applicant has amended the claimed invention to clearly distinguish over the cited prior art.

**35 U.S.C. § 102(b) Anticipation Rejections**

Claims 1, 2, 5, 6, 9 through 12, 15 and 58 through 60 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,248,614 to Kodnani et al. ("Kodnani").

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Kodnani teaches modification of a passivation layer to increase the adhesion between the underfill layer and the passivation layer **after underfilling**. Kodnani teaches that a passivation layer is chemically modified to be more reactive. Subsequently, a coupling agent is applied to the passivation layer. (Col. 4, lines 53-57). "Upon [underfill encapsulant] **curing** the underfill encapsulant **under the appropriate conditions** . . . chemically reacts with the polyamine coupling agent." (Col. 6, lines 60-63). Therefore, Kodnani teaches the use of a chemically

modified passivation layer in combination with a coupling agent layer that conditionally exhibits the ability to chemically react with both the passivation layer and the underfill encapsulant layer.

In contrast to Kodnani, claim 1 recites, among other things, “applying a wetting agent layer.” Kodnani offers no teaching or suggestion for applying a layer with wetting characteristics whatsoever. Therefore, independent Claim 1 is allowable because Kodnani does not identically describe in as great a detail either explicitly or inherently all the elements of the claimed invention as set forth in independent claim 1.

Claims 2, 5, 6, and 9 each are allowable as depending directly from independent Claim 1, which is allowable. Applicants respectfully request that the 35 U.S.C. § 102(e) rejection be withdrawn.

Concerning Claim 9, contrary to Examiner’s assertion, Kodnani does not describe increasing the surface tension of a surface. Rather, Kodnani describes or illustrates that a chemical reaction, may occur under the appropriate conditions to bind the passivation layer to the underfill layer. Kodnani is unsure of the adhesion mechanism and states, “**Not wishing to be bound by theory**, it is believed that during reflow the polyamine reacts with the modified passivation on the surface of the passivation. However, there are still unbound amine sites along the polyamine chain for further reaction with the underfill material to provide the adhesive strength of the present invention.” (Col. 6, lines 45-52). Kodnani does not provide even a modicum of any description whatsoever that the polyamine coupling agent increases the surface tension over the surface tension of the modified passivation layer. Kodnani does not describe anywhere whatsoever that a wetting agent be applied. Further, Kodnani does not describe that addition of the polyamine layer would affect wettability.

Even assuming, *arguendo*, that the chemical reactions could affect wettability, Kodnani describes that the chemical reactions occur **upon curing and under appropriate conditions of** the underfill encapsulant. Thus, the chemical reactions taught by Kodnani cannot affect wettability because the chemical reactions occur **after** flow and **upon** curing of the underfill. (Col. 6, lines 60-63). Therefore, Kodnani does not describe each and every element of the claim,

shown in as complete detail as is contained in the claim. Therefore, Applicant respectfully submits that Claim 9 is allowable, and the rejection should be withdrawn.

Further, assuming, *arguendo*, that the chemical reactions would affect wettability, the modified passivation surface may be more wettable than the coupling agent, and thus, addition of the polyamine coupling agent may reduce the surface tension of the modified passivation surface. Kodnani makes no assertion with respect to the wettability, surface tension, or reactivity of the modified passivation surface **compared to** the coupling agent. Therefore, Kodnani does not describe each and every element of Claim 9. Applicant respectfully requests that the anticipation rejection be withdrawn.

Independent Claims 10 and 58 each recite, *inter alia*, “applying a wetting agent layer to one of said active surface of said semiconductor device and said upper surface of said substrate.”

Kodnani teachings are outlined above and fail to teach a wetting agent. Accordingly, the rejections to Claims 10 and 58 should be withdrawn.

Claims 11, 12, and 15 each depend directly from independent Claim 10, which is allowable. Accordingly, Applicant respectfully submits that Claims 11, 12, and 15 are each allowable and each anticipation rejection should be withdrawn.

Claim 59 depends directly from independent Claim 58, which is allowable. Accordingly, Claim 58 is allowable and the anticipation rejection should be withdrawn.

### **35 U.S.C. § 103(a) Obviousness Rejections**

Claims 4, 13, 14, 16 through 30 and 59 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,248,614 to Kodnani et al. (“Kodnani”) as applied to claims 1, 2, 5, 6, 9 through 12, 15 and 58 through 60 above, and further in view of U.S. Patent 5,766,982 to Akram et al. (“Akram”).

Applicant further submits that to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of

ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the cited prior art reference must teach or suggest all of the claim limitations. Furthermore, the suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure.

The teachings or suggestions of Kodnani are outlined hereinabove. Akram teaches a method and apparatus for underfilling the gap between a semiconductor device and substrate. (Col. 2, lines 52-54). Notably, Akram teaches that underfilling may be accomplished while the substrate and semiconductor assembly is inclined. (Col. 2, lines 60-64).

There is no motivation to combine the teachings of Kodnani with Akram because Akram teaches away from Kodnani. Akram advocates a method in which is cost effective and utilizes standard substrates. (Col. 2, lines 46-49). Further, Akram teaches away from underfilling processes that require additional equipment or specialized substrates. (Col. 2, lines 32-42). Kodnani, on the other hand, teaches that the passivation layer, must be chemically modified. (Col. 4, lines 53-55). Therefore, Kodnani requires an oxygen plasma chamber or an ultraviolet O<sub>3</sub> reaction chamber. In either embodiment, additional equipment is required in order to achieve the teachings of Kodnani. (Col. 5, lines 3-15). Further, Konani teaches that polyimine is applied to the chip surface; thus, additional equipment is required. (Col. 5, lines 16-19).

Applicant submits that it "is improper to combine references where the references teach away from their combination." M.P.E.P. §2145(X)(D)(2) (citing *In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983)).

In addition, Kodnani is directed toward enhancing the adhesion of the chip passivation and underfill interface. Akram is directed toward a cost effective method and apparatus for performing underfilling that results in uniform and substantially void and air free underfill material. Akram purportedly achieved its intended purpose; a cost effective means to achieve void free underfill. Therefore, one of ordinary skill in the art would not be motivated to combine Akram with Kodnani because Akram achieved its intended purpose.

Also, one of ordinary skill in the art would not be motivated to combine Kodnani with Akram because combination of the references would change the principle of operation of Kodnani. Therefore, Applicant respectfully submits that a person of ordinary skill in the art would not have been motivated to rely on the Akram reference since it appears that Kodnani and Akram each teach underfill systems with mutually exclusive operating principles. "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." M.P.E.P. §2143.01 (citing *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

In addition, the combination of Kodnani and Akram fails to teach all of the claim limitations. As outlined above, Kodnani fails to teach or suggest applying a wetting agent. Akram likewise fails to teach or suggest applying a wetting agent.

In contrast, Claims 1 and 10 recite, *inter alia*, "applying a wetting agent layer." Therefore, Claim 4 is allowable as depending directly from independent Claim 1, which is allowable. Claims 13, 14, and 16 through 30 are each allowable as each depend either directly or indirectly from independent Claim 10, which is allowable. Similarly, Claim 59 is allowable as depending directly from independent Claim 58, which is allowable as reciting, *inter alia*, "applying a wetting agent layer."

Claims 30 and 31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kodnani as applied to claims 1, 2, 5, 6, 9 through 12, 15 and 58 through 60 and Akram as applied to claims 4, 13, 14, 16 through 30 and 59 above, and further in view of U.S. Patent 5,203,076 to Banerji et al. ("Banerji").

First, there is no motivation to combine the references. There is no motivation to combine Akram with Banerji because Akram specifically references Banerji, and notes that Banerji requires specialized equipment in order to address non-uniform underfilling processes. (Col. 2, lines 39-42). One of ordinary skill in the art would not be motivated to combine Akram

with Banerji, because Akram discourages such a combination. There is no motivation for the combination of Kodnani with Akram, as outlined hereinabove.

Also, one of ordinary skill in the art would not be motivated to combine Kodnani, Akram or Banerji, in any configuration, because any combination of the references would change the principle of operation of at least one other reference. Therefore, Applicant respectfully submits that a person of ordinary skill in the art would not have been motivated to rely on the Banerji reference since it appears that Kodnani, Akram, and Banerji each teach underfill systems with mutually exclusive operating principles. "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious."

M.P.E.P. §2143.01 (citing *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Also, the combination of Kodnani, Akram, and Banerji fails to teach all of the claim limitations. As outlined above, Kodnani fails to teach or suggest applying a wetting agent. Akram likewise fails to teach or suggest applying a wetting agent. Banerji further fails to teach or suggest applying a wetting agent whatsoever.

Claims 30 and 31 are each allowable as depending directly or indirectly from independent claim 10, which is allowable as reciting, *inter alia*, "applying a wetting agent layer." Applicant respectfully requests that the 35 U.S.C. § 103(a) Obviousness Rejections to Claims 30 and 31 be withdrawn.

Applicant submits that claims 1 through 32 and 58 through 62 are clearly allowable over the cited prior art.

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Applicant requests the allowance of claims 1 through 32 and 58 through 62 and the case passed for issue.

Respectfully submitted,



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Enclosure: Version with Markings to Show Changes Made

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